Comparison With Other EDM Efforts

	Current Bound	Future Goal	$\sim d_n$ Equivalent
Neutron	$d_n < 3\times10^{-26}$ e-cm	$\sim 10^{-28}$ e-cm	10^{-28} e-cm
^{199}Hg atom	$d_{Hg} < 2\times10^{-28}$ e-cm	$\sim 2\times10^{-29}$ e-cm	$10^{-25} - 10^{-26}$ e-cm
^{129}Xe atom	$d_{Xe} < 6\times10^{-27}$ e-cm	$\sim 10^{-30} - 10^{-33}$ e-cm	$10^{-26} \sim 10^{-29}$ e-cm
Deuteron	-	10^{-29} e-cm	$3\times10^{-29} - 5\times10^{-31}$ e-cm

Deuteron Competitive - Better !

Marciano
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Electric Dipole Moment precesses in an Electric field

$$\frac{d\vec{s}}{dt} = \vec{d} \times \vec{E}$$

Electric Dipole Moments in Storage Rings

$$\frac{d\vec{s}}{dt} = \vec{d} \times \left(\vec{v} \times \vec{B} \right)$$

e.g. 1T corresponds to 300 MV/m for relativistic particles

Deuteron EDM

- High sensitivity to CP-violation
- Negligible SM background
- Physics beyond the SM (esp. SUSY) expect CP-violation within reach
- Great sensitivity to T-odd Nuclear Forces
- Complementary and better than nEDM
- If observed it will provide a new, large source of CP-violation that could explain the Baryon Asymmetry of our Universe (BAU)

Physics Motivation

$$dEDM \simeq 10^{-24}\,\mathrm{e}\cdot\mathrm{cm}\times\sin\delta\times\left(\frac{1\ \mathrm{TeV}}{M_{SUSY}}\right)^{2}$$

- Deuteron EDM at 10^{-29}e·cm has a reach of >10^{2} TeV or, if new physics exist at the LHC scale, 10^{-5} rad CP-violating phase. Both are much beyond the design sensitivity of LHC.
- NP Long Range Plan includes strong support of dEDM development recognizing its physics potential.

Experimental Principle of dEDM

- Polarize
- Interact with an E-field
- Analyze as a function of time

Storage ring EDM: The deuteron case

- High intensity sources (~10^{11}/cycle)
- High vector polarization (>80%)
- High analyzing power (30-50% for P=0.8-1.5 GeV/c)
- Long spin coherence time possible (>100s)
- Large effective E^*-field=$\gamma V \times B$, 1T→300MV/m